Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

A modular micro impedance pump: a scalable concept for driving fluid and mixing in integrated microfluidic systems DEREK RINDERKNECHT, MORY GHARIB, California Institute of Technology — Functional microfluidic systems require architectures which allow for precise control and mixing of very small volumes of fluid. In order for these systems to become effective and as the need becomes greater to fit more functionality on a single chip, pumps will remain fundamental components of microfluidic systems. Exploiting the basic principles of impedance based pumping, we have shown that the impedance pump can be constructed in a wide variety of configurations and is scaleable to dimensions of a few hundred microns. Here we present experimental studies of the flow performance of a valveless micro impedance pump as well as explore its use in the context of a specific application, micro mixing. The pump, formed by a closed rectangular channel that is 200 microns in depth, 3 mm wide and 15 mm in length, has no complex parts and is easily adaptable to patterning by soft lithography. Flow rates of up to 16 microliters/min have been measured using high speed micro-PIV. Imaging of impedance pump driven micro flows has revealed that the flow is pulsatile at frequencies in excess of 100 Hz. The microfluidic system demonstrated in this work utilizes the flow unsteadiness combined with the interaction between the fluid and structures placed in the flow to enhance mixing efficiency at low Reynolds number.

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Date submitted: 15 Aug 2005 Electronic form version 1.4